

The Taxonomist's Dilemma

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Taxonomists, or at least the services they provide, are suddenly in demand. This is not quite the same as saying that taxonomy has regained its earlier popularity — indeed there are signs that in some of the developed countries the number of students going on to seek taxonomic training is decreasing after reaching a peak in the 1960's. Teaching and research schools are in some cases being run down and in some major European universities they are non-existent. Likewise many important museums and herbaria are understaffed and the accumulation of unidentified material is often of massive proportions.

The pressure for an increase in the number of taxonomists stems largely from the growing and realistic appreciation of both the extent and pace at which man has been consuming, destroying, modifying and deteriorating our global environment, and in particular our plant resources which form the very base of the life-support systems of our planet (Heslop-Harrison, 1975), and from the initiatives that have been proposed to combat this. The most important recognition of the dangers facing plant life, and of the consequences for man if urgent steps are not taken to moderate them, comes from the United Nations Conference on the Human Environment held in Stockholm in 1972 and the ensuing recommendations 39-45 of the Declaration on the Human Environment dealing with plant and animal resources, their survey and conservation. If one considers the main recommendations, they cover survey of plant genetic resources, preparation of inventories, field exploration and collecting, conservation in nature and in gardens and seed banks. To those of us who work as practising taxonomists this sounds all too familiar, since it is a fair summary of the kinds of activities in which we and previous generations of taxonomists have been engaged for the past two centuries. What does the taxonomist do if not explore plant resources in the field throughout the world and produce checklists, Floras, keys and monographs, which are essentially inventories with a greater or lesser amount of detail? Yet the role of taxonomy is not explicitly recognized. Conservation, resources, ecology have become accepted words, even today understood by governments, but taxonomy still does not have a familiar ring and the term classification still retains a pejorative gloss. A similar failure to appreciate the role of taxonomy was a characteristic of the International Biological Programme, yet the evidence of the urgent need to extend floristic exploration, especially in areas at high risk such as the tropics, sub-tropics, islands and areas of Mediterranean climate, was fully available. Among those to draw attention to the need to study the tropical floras, Corner was prominent as early as 1946. His appointment to a professorship of Tropical Botany by the University of Cambridge was a belated recognition of both the importance of his work and his personal standing, but his pleas for action went largely unheard by governments and international agencies.

Explicit recognition of the need for an expansion of taxonomic work was given at the 18th General Assembly of the International Union of Biological Sciences in 1973, which passed resolutions recommending that special attention be

given to the improvement of the services providing for the identification of animal and plant species, as well as to the improvement of the flow of information on taxonomic data to all other relevant disciplines, and requesting that the Executive Committee point out to the national adhering organizations the great importance of the training of biological taxonomists. Similar resolutions have been passed by congresses and symposia but it would be unrealistic to expect any substantial action to be taken by governments especially in the present economic climate. The problems of supply and training of taxonomists have already been alluded to briefly and will be discussed further below.

It is against the above background that taxonomists work today; not a particularly comforting one. It contrasts with previous generations of taxonomists who worked with a high degree of tranquillity, not faced with an agonizing series of choices of techniques, priorities, philosophies.

In the post-Linnean period, as the exploration of new territories in various parts of the world gathered momentum and material flowed into botanic gardens, herbaria and museums, taxonomy rapidly progressed from being essentially a codification of folk biologies, and mainly West European, to a world-wide system of classification and communication for biology. The fact that this fundamental change in the nature of taxonomy had taken place was scarcely realized at the time (Heywood, 1974). Indeed one of the unfortunate consequences of the acceptance of Darwinian evolutionary theory was that attention was diverted from the practical data-processing role of taxonomy to an almost obsessive compulsion to seek evolutionary interpretations of taxonomic data and to place all organisms in their correct place on so-called phylogenetic trees. This preoccupation with evolutionary explanation has, quite understandably, continued to the present day: in the age of evolutionary biology it could scarcely be otherwise. What has seldom been assessed is what the effect on practical classification has been. To the extent that comparative data have been deliberately discarded or ignored in favour of supposedly phylogenetically significant features, and thereby departing from the principles of classification based on maximum co-variation or correlation of characters, it is arguable that taxonomy has been greatly retarded. This, combined with the tendency to decry the importance of taxonomy as an information system, may well have set classificatory taxonomy back ten or twenty years. Today when we have powerful tools for the study of phylogeny, such as numerical cladistics, and powerful new classes of data, such as amino acid sequences of cytochromes *c* and plastocyanins, we are in a situation where we have to consider seriously whether we can afford to devote a major effort to this kind of study, or whether we should concentrate our energies and resources on floristic exploration and writing Floras and monographs. Similarly we must ask whether detailed study of micro-characters by scanning electron microscopy, chemical features by gel electrophoresis, chromatography, etc., or the population structure of temperate species of no known or potential economic, ecological or agronomic importance, can be justified.

To answer that we must continue to do both is to sidestep the dilemma that faces us today. What then has happened that has forced us into this situation? Quite simply, our predecessors, after earlier naive assumptions as to the numbers of the world's biota, came to realize that the task facing them in exploring, describing and understanding the world's flora and fauna was virtually limitless, but that it would only be a matter of time before the basic inventorying would be complete. The great museums and herbaria were established and collections were amassed from region after region as part of an apparently never-ending process. For political-historical reasons, floristic exploration and Flora-writing was a feature associated with imperialism and colonialism as regards the under-developed, largely tropical, parts of the world and no global assessment of progress was ever seriously made.

It is only in the course of the last five to ten years that we have come to realize that the end is in sight and that we have achieved much less than we had realized. This new situation has arisen because of expanding world populations and increased expectations as regards living standards, with all the consequent destruction of natural vegetation, especially tropical forest, which is basically non-renewable, for living room, cultivation, industrialization, etc. The statistics are horrifying and sufficiently well documented to need no repetition here. The almost inevitable outcome will be massive world-wide extinction of the world's most interesting and economically valuable floras and their replacement, where there is space still available by some form of secondary and relatively uniform vegetation.

The probability that about 85% of the world's extant organisms have not yet been described need not concern us here: there never was any possibility that they would or even should all ever be discovered and named. The position concerning higher plants is on the face of it much more satisfactory — it is estimated that about 250,000 species of angiosperms have been recognised and that only 10-20,000 still remain to be discovered and described. Unfortunately we know very little about the great majority of the quarter million species apart from some of their basic morphology and some distributional and ecological data. For only a tiny minority do we possess details of their karyology, population structure, chemical constituents, breeding system, etc.

What makes the situation so serious is not the eventual outcome but the alarmingly rapid rate at which species by the hundred and thousands and indeed whole ecosystems, are either disappearing or becoming threatened. While we can make estimates such as those which suggest that up to 20,000 angiosperm species are threatened or even in danger of extinction, our impotence is triple in that (1) the majority are in tropical or sub-tropical areas of the world, (2) we do not have the means of taking action on a sufficiently massive scale to avoid the inevitable extinction of a high percentage of them due to lack of funds and trained manpower, not to mention sociological and political factors, and (3) we have no means of knowing, even were the resources available to tackle the problem, exactly which species are in greatest peril.

Despite the valiant efforts of the IUCN and its Threatened Plants Committee to identify and catalogue the threatened species. It is only in cool temperate and perhaps Mediterranean regions where this will be achieved in time.

The immensity of the problem in the tropics is such that the action needed is vastly in excess of the manpower and resources available or likely to become available in the near future and we can only hope that a sufficient number of national parks and reserves can be established and maintained so as to allow us to retain for future generations some reasonably representative samples of the floristic richness and resources of the various countries and regions concerned. In addition to such natural reserves, it is necessary to establish seed banks and living resources centres, especially in scientifically organized Botanic Gardens as discussed at the Kew Conference held in September 1975 sponsored by the NATO Eco-Sciences Panel. Such action is already being organized by various international agencies for cultivated plants and their wild relatives, which is a big enough task in itself, but it must be extended to deal with at least some of the wild species to which no economic importance is at present attached. Just how such species should be selected is a major problem since, as indicated above, our detailed knowledge of large parts of tropical floras is so limited that we cannot in many cases say which of them are threatened.

In the light of the situation a positive response is needed from the taxonomic community, yet all too often the reaction is either that the problem is so vast that nothing any individual taxonomist can do will have any effect, or that the whole question is one for politicians, economists, and governments, not scientists.

I believe that this is unduly pessimistic an attitude to take. The taxonomist is often uniquely qualified to know what the situation is in a particular area and a great deal could be done by devoting effort to identifying areas or species at high risk and further by assembling this information for general use. One urgent task is to make a world survey, country by country of the floristic situation — what the size of the flora is, how far it has been studied, what Floras are available, are in preparation or are being planned, what the manpower situation is, which countries are involved, what assistance is needed. Surveys of this kind have been undertaken for Europe through the *Flora Europaea* organization, for the Mediterranean through the CNRS symposium on the Mediterranean basin held in Montpellier in June 1973 and through a working party of the OPTIMA organization and for all Africa south of the Sahara by AETFAT.

There is a widespread feeling amongst taxonomists that they should have freedom to work on any group no matter what the overall situation might be. At the risk of being highly unpopular, I feel that such an attitude is today somewhat arrogant, especially when one considers that most taxonomists are employed from public funds. Very few scientists today have such freedom of choice and I believe that taxonomists today should seriously consider whether there is not some positive action they could take to help in a small way to alleviate the situation outlined above. It is easy enough to append signatures to resolutions and to lament the perils facing the world's flora but this is hypocritical if at the same time research programmes are undertaken without regard to these considerations. It would not be difficult to compile a list of taxonomic groups deserving high priority either because they contain many threatened species or because they are of economic importance, and have not been adequately studied or revised. Closer collaboration, for example, between taxonomists and agronomists and plant breeders should be urged in areas such as exploration of genetic resources, collecting material for seed banks and living collections.

There are two further areas which should make claims on our time — education and training. Our first concern should be to try and educate our colleagues by explaining patiently the need for what seems to them quite routine and unspectacular research. To a large extent our own insistence that we are all evolutionary biologists concerned with the solution of what to the outsider may seem quite parochial problems has been largely responsible for our failure to convince our colleagues of the seriousness of the threats facing plant resources today. However intellectually stimulating the search for evolutionary ancestors may be, it has diverted attention from the real-life situation. For too long, conservation has been left in the care of the prophets of doom, rather than accepting our own responsibilities to present the hard facts in a realistic way. If we, as taxonomists, with our own intimate knowledge cannot get the message across, then who will?

Training of taxonomists prevents a whole series of problems. Those of us with the facilities and staffing have a moral responsibility to accept the rôle of training, as best we can, taxonomists for those countries where qualified staff are distinguished by their scarcity. Our aim should be to train the teachers so that they can take over the tasks in their own land. At the same time we should resist attempts by government to restrict our rôle in this area because of temporary economic difficulties.

Finally we should draw attention to the consequences if we do not take action on a large enough scale. It is not just the tropical countries but the whole of mankind that will suffer if we are to do too little, too late. We have a responsibility not only to ourselves but to future generations.

Professor Corner was one of the first to draw attention to the taxonomist's dilemma. If we have any criticism to make it is that he did not from his wisdom plead the case with even greater eloquence than he did.

References

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